

ERL specification update for C2M Host Output

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04/24/2019 IEEE 802.3 100 Gb/s, 200 Gb/s, and 400 Gb/s Electrical ad hoc meeting

Agenda

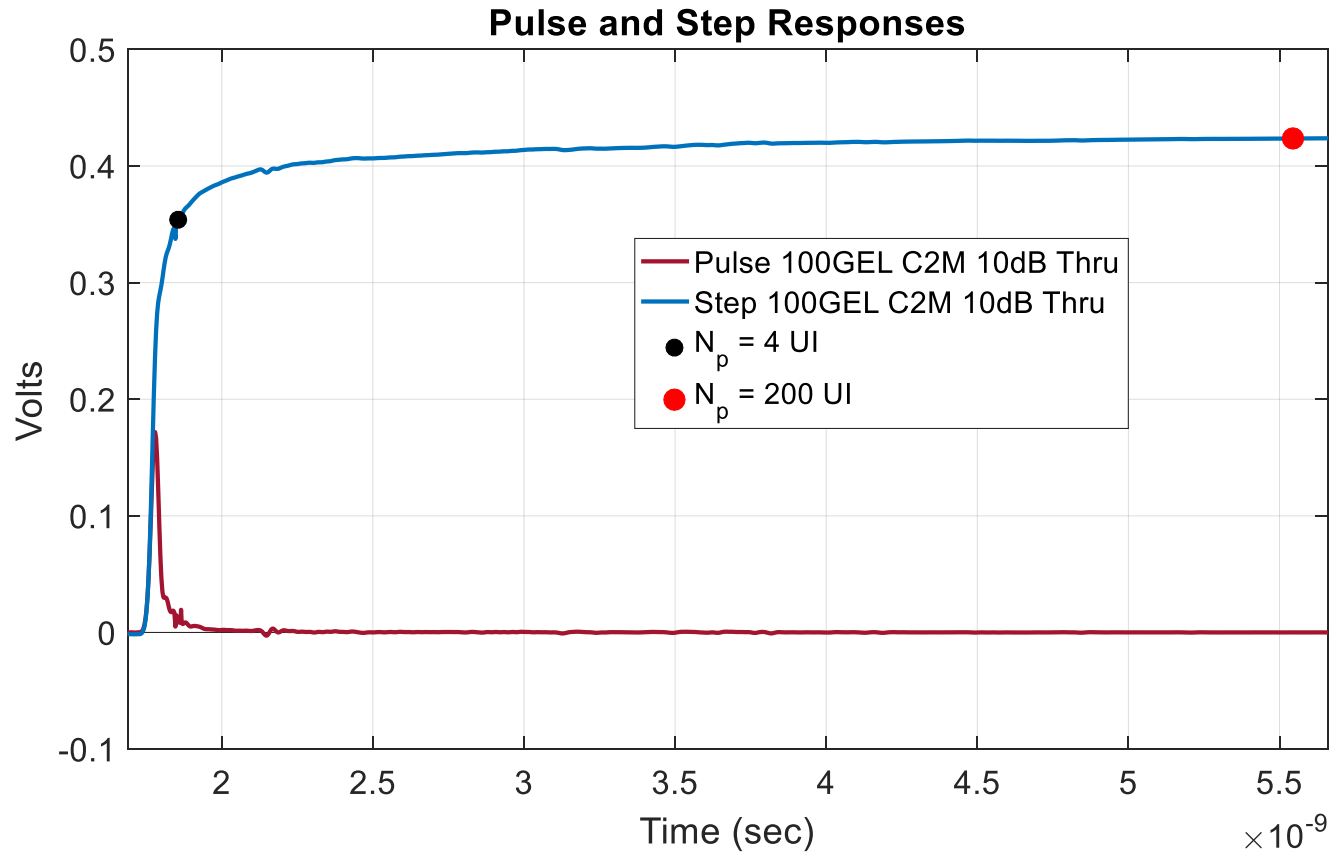
- ❑ Experiment description
- ❑ Update for V_f
- ❑ Observations of RL plots
- ❑ Mosaic Heat Map
- ❑ Example pass fail comparison between ERL and RL mask failures
- ❑ Recommended ERL parameters for C2M host output
- ❑ Summary

Getting started to determine C2M ERL limits

- ❑ Evaluate a the collection of 60 C2M channels
 - With package 1 and package 2
 - <http://www.ieee802.org/3/ck/public/tools/index.html>
- ❑ COM Evaluation Starting point
 - Reference receiver combining Type B from sun_3ck_01_0319.pdf and ghiasi_3ck_01a_0319.pdf
 - RxFFE4 and no DFE (see COM sheet)
 - This work may be refined once a COM parameters are more stable
- ❑ Compare 'Mosaic heat plots' for VEO vs ERL limits
- ❑ VEC and EW (eye widht) not included at this time

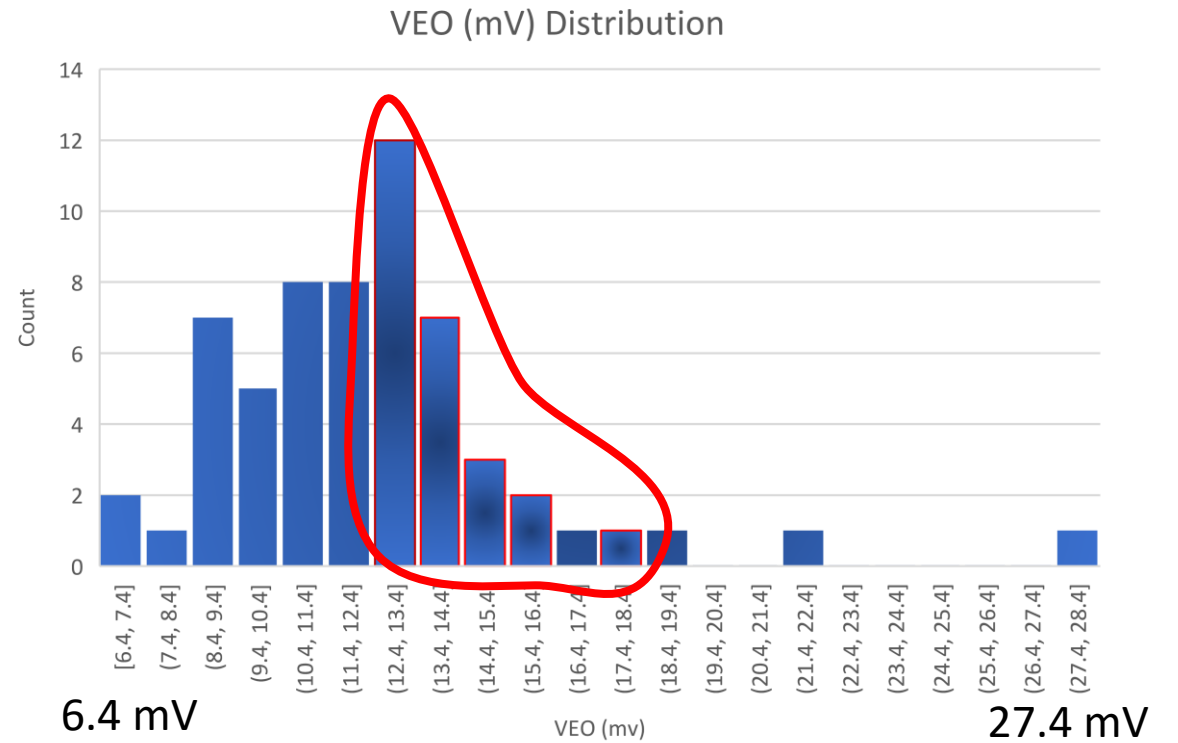
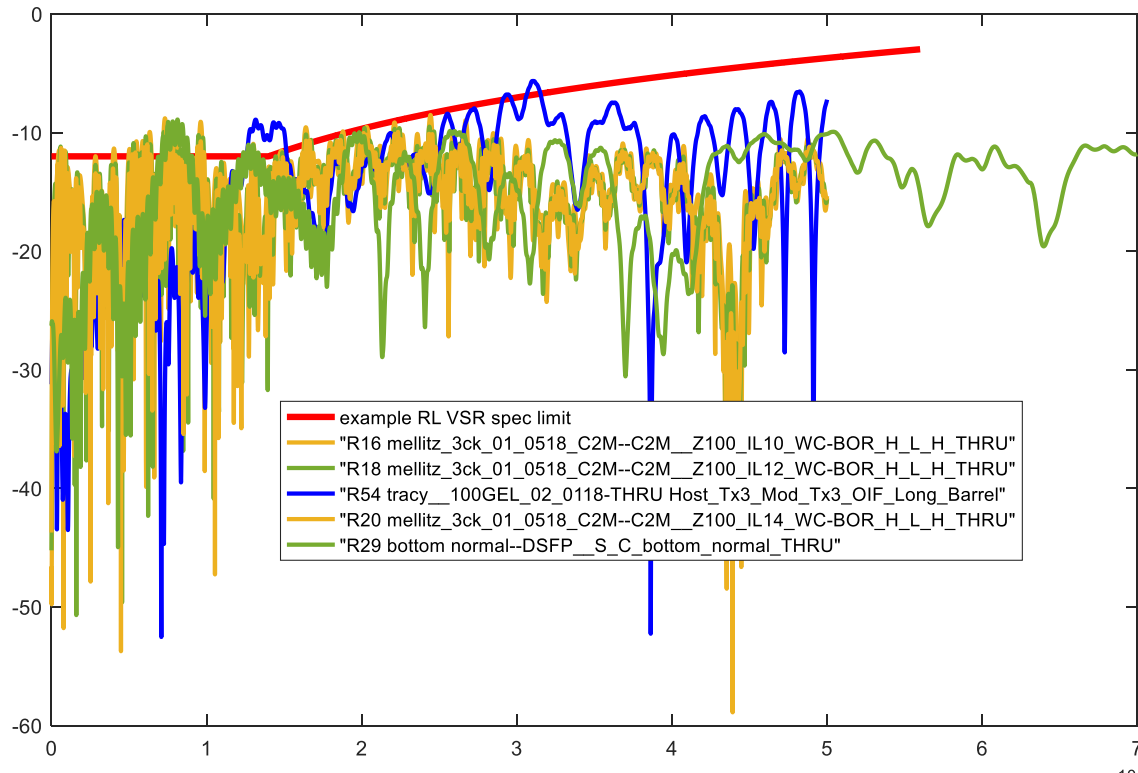
$N_p = 200$ for computation of V_f is an indication of host loss which is independent of equalizer choice.

Visit N_p later once equalization choices are more stable



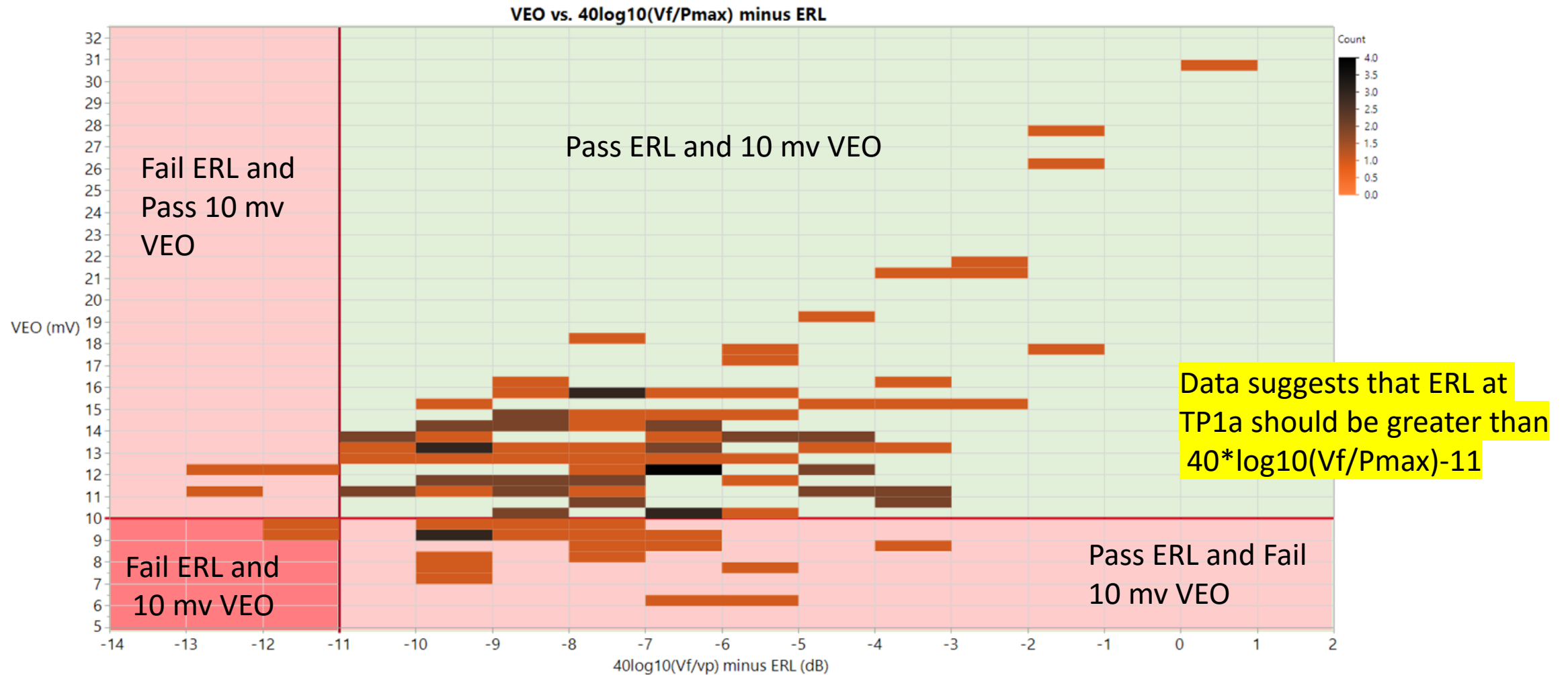
Better represents loss of the channel

Some of the most open eyes have the worst RL plots

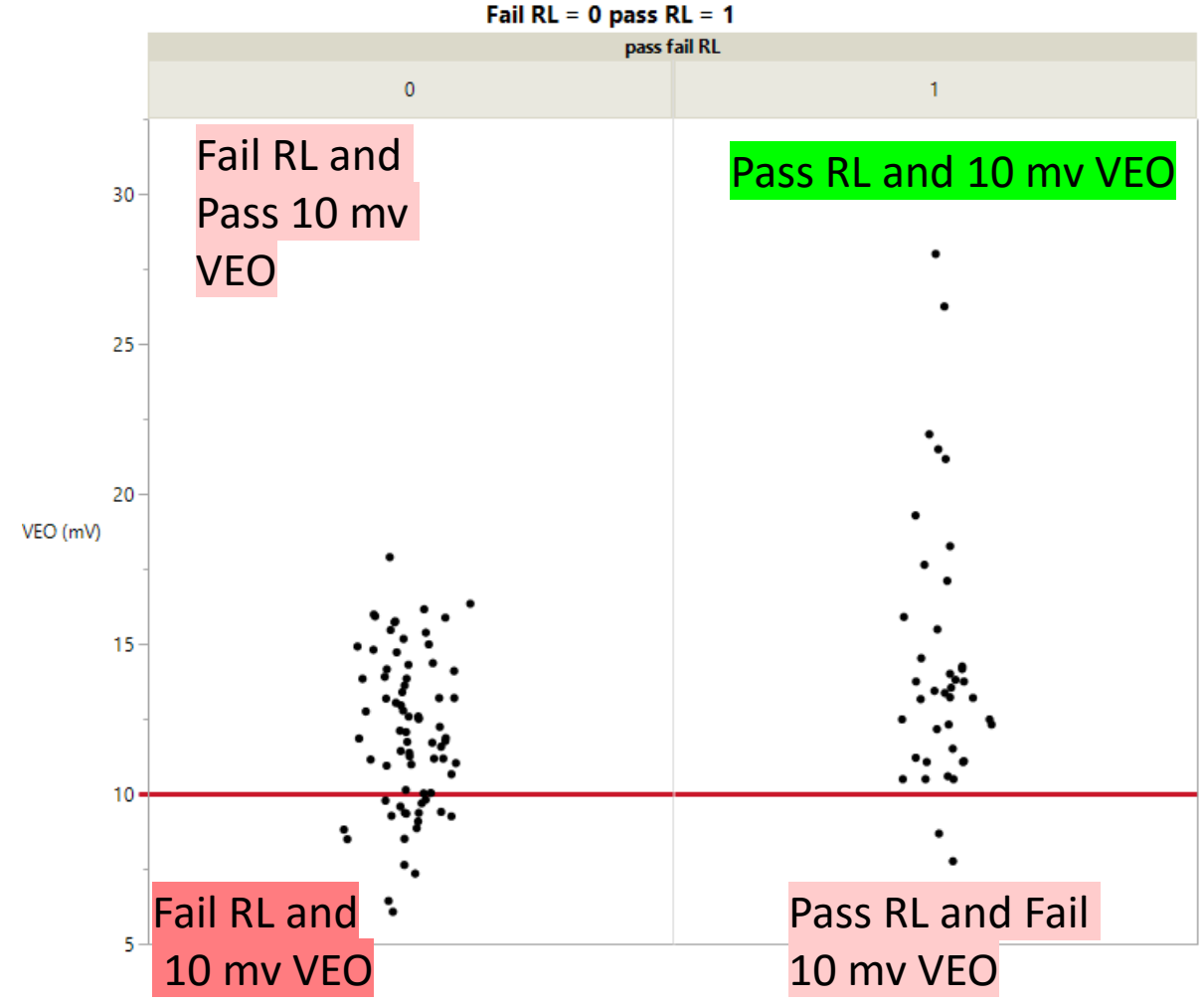
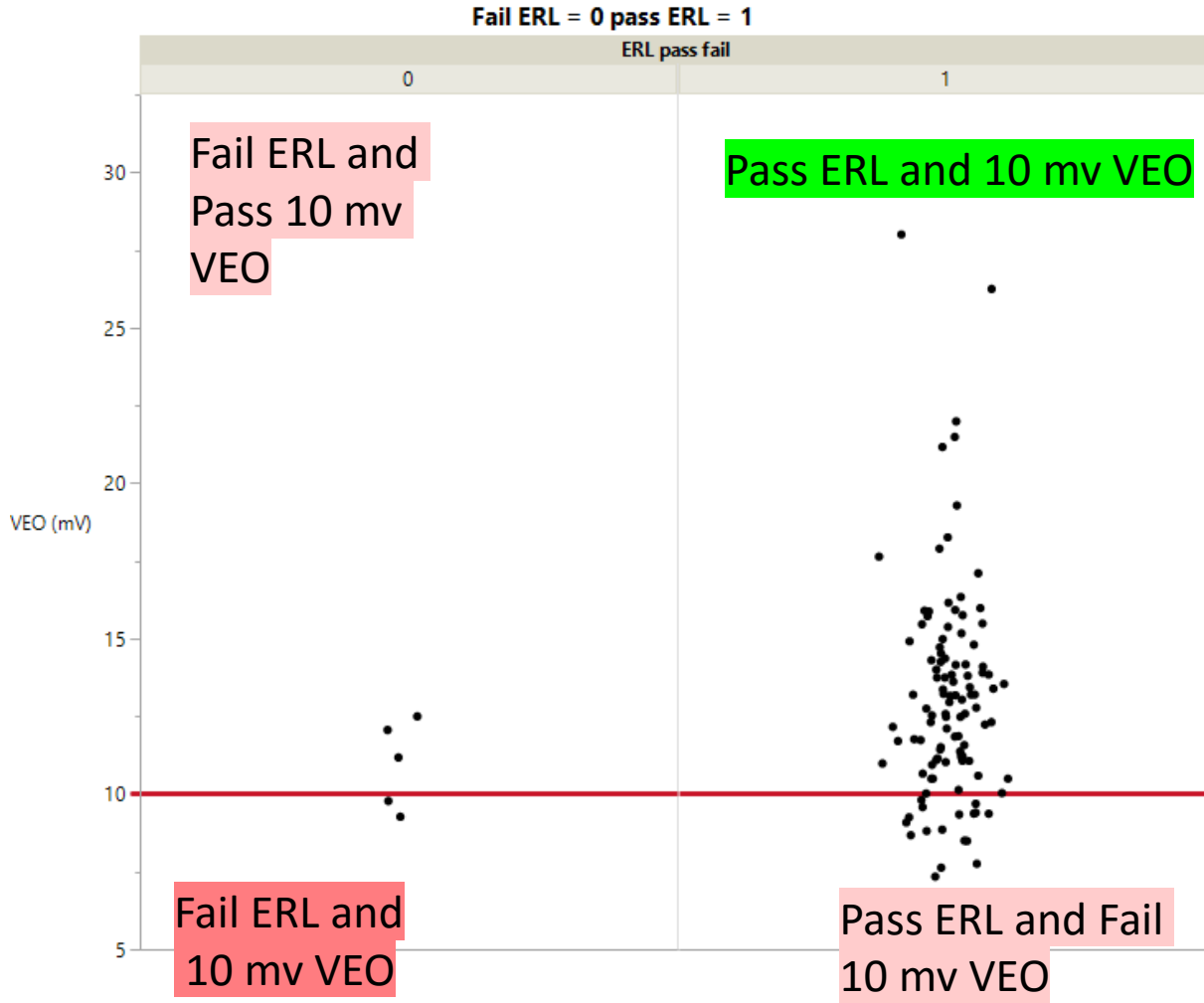


IL (dB)	Min DER	VEO (mV)	VEC_dbB (est.)	40*log10(vf/vp)	ERL22 (at TP1a)	ERL Proposed Limit 40*log10(vf/vp)-11 dB	names	RL Mask limit margin
10.0	3.39E-05	17.89	10.11	12.38	10.6	1.4	"R16 mellitz_3ck_01_0518_C2M--C2M_Z100_IL10_WC-BOR_H_L_H_THRU"	-3.21
12.2	2.80E-05	15.46	9.90	14.44	11.4	3.4	"R18 mellitz_3ck_01_0518_C2M--C2M_Z100_IL12_WC-BOR_H_L_H_THRU"	-2.91
15.4	1.41E-06	14.98	7.83	17.71	11.0	6.7	"R54 tracy_100GEL_02_0118-THRU_Host_Tx3_Mod_Tx3_OIF_Long_Barrel"	-3.10
16.1	8.51E-07	13.61	7.55	18.74	8.0	7.7	"R30 bottom worst--DSFP_S_C_bottom_worst_THRU"	-2.41
13.9	2.54E-05	13.39	9.80	16.43	12.7	5.4	"R20 mellitz_3ck_01_0518_C2M--C2M_Z100_IL14_WC-BOR_H_L_H_THRU"	-2.20
16.5	4.33E-06	12.06	8.43	18.75	7.7	7.7	"R29 bottom normal--DSFP_S_C_bottom_normal_THRU"	-3.11

“Mosaic Heat plots” suggest an ERL spec based on 10 mV VEO minimum at TP1a



RL masks seem to reject more channels



ERL Parameters for Host Output AUI

□ $\rho_x = 0.32$

□ $G_x = 1$

□ $\beta_x = 0$

□ $Tr = 10 \text{ ps}$

□ $N = 800$

□ $Nbx = 4$

□ $ERL \text{ (at TP1a)} > 40 \log_{10} \left(\frac{V_f}{\max_k (p(k))} \right)$

- $N_p = 200$

- Reference original work in [dudek_3cd_01a_0718.pdf](#)

Summary

- ❑ Recommend extending N_p to 200 for V_f measurement
- ❑ Recommend ERL gating function in mellitz_3ck_adhoc_01a_032719.pdf, slide 8
 - I.e. $G_x=1$
- ❑ Recommend for ERL limit C2M host
 - $ERL (at TP1a) > 40 \log_{10} \left(\frac{V_f}{\max_k (p(k))} \right) - 11 \text{ dB}$

Backup Data

- ❑ COM configuration parameter spread sheet
- ❑ Channel file key

COM Configuration Sheet (COM 2.66)

Setting	Units	Information
53.125	GBd	
0.05	GHz	
0.01	GHz	
[1.1e-4 0]	nF	[TX RX]
[1 2]		[test cases to run]
[15 32 ; 1.8 1.8]	mm	[test cases]
[0 0 ; 0 0]	mm	[test cases]
[15 32 ; 1.8 1.8]	mm	[test cases]
[0 0 ; 0 0]	mm	[test cases]
[0.87e-4 0]	nF	[TX RX]
50	Ohm	
[45 50]	Ohm	[TX RX]
0.41	V	
0.41	V	
0.6	V	
4		
32		
0.75	*fb	
0.6		min
[-0.2:0.02:0]		[min:step:max]
[0:.02:0.1]		[min:step:max]
00:00.0		[min:step:max]
[-0.1:0.05:0]		[min:step:max]
0	UI	
0.5		
0.2		
[-14:0.5:-4]	dB	[min:step:max]
18.5534	GHz	
28.2	GHz	
53.125	GHz	
[-3.:0.5:0]		[min:step:max]
1.328125	GHz	
0	UI	
4	UI	
0		
0.7		
0.3		
0.3		
0.125		

I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	1	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\100GEL_WG_{date}	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	C2M_0419	
COM_CONTRIBUTION	0	logical
Operational		
COM Pass threshold	3.8	dB
ERL Pass threshold	10.5	dB
EH_min	10	mV
EH_max	1200	mV
DER_0	1.00E-05	
T_r	6.16E-03	ns
FORCE_TR	1	logical
Include PCB	0	logical
TDR and ERL options		
TDR	1	logical
ERL	1	logical
ERL_ONLY	0	logical
TR_TDR	0.01	ns
N	600	
TDR Butterworth	1	logical
beta_x	0.00E+00	
rho_x	0.32	
fixture delay time	0	s
TDR_W_TXPKG	1	
N_bx	4	UI
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
Noise, jitter		
sigma_RJ	0.01	UI
A_DD	0.02	UI
eta_0	8.20E-09	V^2/GHz
SNR_TX	33	dB
R_LM	0.95	

Table 93A-3 parameters		
Parameter	Setting	Units
package_tl_gamma0_a1_a2	[0 0.0009909 0.0002772]	
package_tl_tau	6.1400E-03	ns/mm
package_Z_c	[87.5 87.5 ; 92.5 92.5]	Ohm

Table 92-12 parameters		
Parameter	Setting	
board_tl_gamma0_a1_a2	[0 3.8206e-04 9.5909e-05]	
board_tl_tau	5.790E-03	ns/mm
board_Z_c	90	Ohm
z_bp (TX)	119	mm
z_bp (NEXT)	119	mm
z_bp (FEXT)	119	mm
z_bp (RX)	119	mm

Channel Key

channel #	name	channel #	name
" 1	12dB--12dB_thru"	" 31	top normal--DSFP_S_C_top_normal_THRU"
" 2	14dB--14dB_thru"	" 32	top worst--DSFP_S_C_top_worst_THRU"
" 3	16dB--16dB_thru"	" 33	bottom normal--OSFP_S_C_bottom_normal_THRU"
" 4	12dB--12dB_thru"	" 34	bottom worst--OSFP_S_C_bottom_worst_THRU"
" 5	14dB--14dB_thru"	" 35	top normal--OSFP_S_C_top_normal_THRU"
" 6	16dB--16dB_thru"	" 36	top worst--OSFP_S_C_top_worst_THRU"
" 7	10dB--100GEL_C2M_10dB_Thru"	" 37	bottom normal--QSFP_S_C_bottom_normal_THRU"
" 8	12dB--100GEL_C2M_12dB_Thru"	" 38	bottom worst--QSFP_S_C_bottom_worst_THRU"
" 9	14dB--100GEL_C2M_14dB_Thru"	" 39	top normal--QSFP_S_C_top_normal_THRU"
" 10	14dB--100GEL_C2M_14dB_Thru"	" 40	top worst--QSFP_S_C_top_worst_THRU"
" 11	16dB--100GEL_C2M_16dB_Thru"	" 41	1_legacy top normal--QSFDD_S_C_legacy_top_normal_THRU"
" 12	10dB--100GEL_C2M_10dB_thru"	" 42	2_additional top normal--QSFDD_S_C_additional_top_normal_THRU"
" 13	12dB--100GEL_C2M_12dB_thru"	" 43	3_additional bottom normal--QSFDD_S_C_additional_bottom_normal_THRU"
" 14	14dB--100GEL_C2M_14dB_thru"	" 44	4_legacy bottom normal--QSFDD_S_C_legacy_bottom_normal_THRU"
" 15	mellitz_3ck_01_0518_C2M--C2M_Z100_IL9_BC-BOR_N_N_N_THRU"	" 45	5_legacy top worst--QSFDD_S_C_legacy_top_worst_THRU"
" 16	mellitz_3ck_01_0518_C2M--C2M_Z100_IL10_WC-BOR_H_L_H_THRU"	" 46	6_additional top worst--QSFDD_S_C_additional_top_worst_THRU"
" 17	mellitz_3ck_01_0518_C2M--C2M_Z100_IL11p2_BC-BOR_N_N_N_THRU"	" 47	7_additional bottom worst--QSFDD_S_C_additional_bottom_worst_THRU"
" 18	mellitz_3ck_01_0518_C2M--C2M_Z100_IL12_WC-BOR_H_L_H_THRU"	" 48	8_legacy bottom worst--QSFDD_S_C_legacy_bottom_worst_THRU"
" 19	mellitz_3ck_01_0518_C2M--C2M_Z100_IL13_BC-BOR_N_N_N_THRU"	" 49	tracy_100GEL_02_0118--THRU_Host_Tx4_Mod_Tx4_OIF_Long_Barrel"
" 20	mellitz_3ck_01_0518_C2M--C2M_Z100_IL14_WC-BOR_H_L_H_THRU"	" 50	tracy_100GEL_02_0118--THRU_Host_Tx5_Mod_Tx5_OIF_Long_Barrel"
" 21	bottom normal--CFP2_S_C_bottom_normal_THRU"	" 51	tracy_100GEL_02_0118--THRU_Host_Tx6_Mod_Tx6_OIF_Long_Barrel"
" 22	bottom worst--CFP2_S_C_bottom_worst_THRU"	" 52	tracy_100GEL_02_0118--THRU_Host_Tx7_Mod_Tx7_OIF_Long_Barrel"
" 23	top normal--CFP2_S_C_top_normal_THRU"	" 53	tracy_100GEL_02_0118--THRU_Host_Tx8_Mod_Tx8_OIF_Long_Barrel"
" 24	top worst--CFP2_S_C_top_worst_THRU"	" 54	tracy_100GEL_02_0118--THRU_Host_Tx3_Mod_Tx3_OIF_Long_Barrel"
" 25	bottom normal--CFP8_S_C_bottom_normal_THRU"	" 55	tracy_100GEL_06_0118--THRU_Host_Rx3_Mod_Rx3_OIF_microvia"
" 26	bottom worst--CFP8_S_C_bottom_worst_THRU"	" 56	tracy_100GEL_06_0118--THRU_Host_Rx4_Mod_Rx4_OIF_microvia"
" 27	top normal--CFP8_S_C_top_normal_THRU"	" 57	tracy_100GEL_06_0118--THRU_Host_Rx5_Mod_Rx5_OIF_microvia"
" 28	top worst--CFP8_S_C_top_worst_THRU"	" 58	tracy_100GEL_06_0118--THRU_Host_Rx6_Mod_Rx6_OIF_microvia"
" 29	bottom normal--DSFP_S_C_bottom_normal_THRU"	" 59	tracy_100GEL_06_0118--THRU_Host_Rx7_Mod_Rx7_OIF_microvia"
" 30	bottom worst--DSFP_S_C_bottom_worst_THRU"	" 60	tracy_100GEL_06_0118--THRU_Host_Rx8_Mod_Rx8_OIF_microvia"

data

IL	BER	VEO	EW	VEC_dbB	pkg	ERL Margin	ERL pass	fa pass	fail	RL names
12.74594	2.10E-05	15.48272	0.130724	9.57128	1	7.178526	1	1	1	"R1 12dB--12dB_thru"
14.01873	2.21E-05	13.36284	0.129767	9.610264	1	6.112979	1	1	1	"R2 14dB--14dB_thru"
15.82964	2.82E-05	12.15691	0.148171	9.811199	1	4.727759	1	1	1	"R3 16dB--16dB_thru"
12.19198	5.71E-06	21.16212	0.141686	8.634021	1	7.293234	1	1	1	"R4 12dB--12dB_thru"
13.98771	1.18E-05	14.52142	0.131261	9.112701	1	5.803634	1	1	1	"R5 14dB--14dB_thru"
15.95873	7.01E-06	13.21853	0.150706	8.75975	1	4.187956	1	1	1	"R6 16dB--16dB_thru"
10.0301	1.69E-04	11.06284	0.08398	12.0238	1	7.360274	1	1	1	"R7 10dB--100GEL_C2M_10dB_Thru"
12.12298	1.76E-05	12.31094	0.118537	9.418813	1	6.16095	1	1	1	"R8 12dB--100GEL_C2M_12dB_Thru"
13.96456	1.46E-04	10.49081	0.095663	11.78654	1	4.884416	1	1	1	"R9 14dB--100GEL_C2M_14dB_Thru"
13.96456	1.46E-04	10.49081	0.095663	11.78654	1	4.884416	1	1	1	"R10 14dB--100GEL_C2M_14dB_Thru"
15.89888	2.87E-05	8.674252	0.115879	9.841457	1	3.382911	1	1	1	"R11 16dB--100GEL_C2M_16dB_Thru"
10.0301	1.69E-04	11.06284	0.08398	12.0238	1	7.360274	1	1	1	"R12 10dB--100GEL_C2M_10dB_thru"
12.12298	1.76E-05	12.31094	0.118537	9.418813	1	6.16095	1	1	1	"R13 12dB--100GEL_C2M_12dB_thru"
13.96456	1.46E-04	10.49081	0.095663	11.78654	1	4.884416	1	1	1	"R14 14dB--100GEL_C2M_14dB_thru"
8.945554	2.29E-07	30.77795	0.223909	7.201199	1	11.04738	1	1	1	"R15 mellitz_3ck_01_0518_C2M--C2M_Z100_IL9_BC-BOR_N_N_N_THRU"
9.95607	3.39E-05	17.89161	0.169776	10.11186	1	9.236902	1	0	0	"R16 mellitz_3ck_01_0518_C2M--C2M_Z100_IL10_WC-BOR_H_L_H_THRU"
11.16053	1.95E-07	26.24597	0.216155	7.14492	1	9.873154	1	1	1	"R17 mellitz_3ck_01_0518_C2M--C2M_Z100_IL11p2_BC-BOR_N_N_N_THRU"
12.18229	2.80E-05	15.46058	0.169052	9.901723	1	8.003572	1	1	1	"R18 mellitz_3ck_01_0518_C2M--C2M_Z100_IL12_WC-BOR_H_L_H_THRU"
13.12136	1.23E-07	21.4866	0.208423	7.015172	1	8.120876	1	1	1	"R19 mellitz_3ck_01_0518_C2M--C2M_Z100_IL13_BC-BOR_N_N_N_THRU"
13.86565	2.54E-05	13.38885	0.16948	9.798605	1	7.226465	1	0	0	"R20 mellitz_3ck_01_0518_C2M--C2M_Z100_IL14_WC-BOR_H_L_H_THRU"
14.6602	4.07E-05	9.578429	0.16233	10.18969	1	1.537894	1	0	0	"R21 bottom normal--CFP2_S_C_bottom_normal_THRU"
14.72862	5.52E-05	9.36449	0.158443	10.51568	1	1.019252	1	0	0	"R22 bottom worst--CFP2_S_C_bottom_worst_THRU"
14.8863	2.94E-07	15.8721	0.190242	7.13074	1	3.06048	1	0	0	"R23 top normal--CFP2_S_C_top_normal_THRU"
15.09546	4.73E-07	13.43284	0.190486	7.31217	1	2.884856	1	1	1	"R24 top worst--CFP2_S_C_top_worst_THRU"
15.56608	1.46E-07	14.24687	0.198173	6.899227	1	2.373848	1	1	1	"R25 bottom normal--CFP8_S_C_bottom_normal_THRU"
15.80796	1.77E-07	13.84153	0.193339	6.942122	1	1.820326	1	0	0	"R26 bottom worst--CFP8_S_C_bottom_worst_THRU"
15.07284	2.90E-08	14.91094	0.20314	6.382575	1	2.970008	1	0	0	"R27 top normal--CFP8_S_C_top_normal_THRU"
15.48293	4.85E-07	14.16567	0.187242	7.315392	1	2.165981	1	1	1	"R28 top worst--CFP8_S_C_top_worst_THRU"
16.50059	4.33E-06	12.06004	0.16008	8.427039	1	-0.023155	0	0	0	"R29 bottom normal--DSFP_S_C_bottom_normal_THRU"
16.0969	8.51E-07	13.61111	0.173253	7.546721	1	0.252357	1	0	0	"R30 bottom worst--DSFP_S_C_bottom_worst_THRU"
14.71436	9.43E-07	11.73407	0.196481	7.626494	1	1.75318	1	0	0	"R31 top normal--DSFP_S_C_top_normal_THRU"
14.8289	9.10E-07	11.70352	0.1936	7.608886	1	1.866472	1	0	0	"R32 top worst--DSFP_S_C_top_worst_THRU"
14.1961	1.27E-08	18.25657	0.209281	6.214304	1	3.254654	1	1	1	"R33 bottom normal--OSFP_S_C_bottom_normal_THRU"
14.41707	2.70E-07	14.09612	0.192438	7.114523	1	3.074137	1	0	0	"R34 bottom worst--OSFP_S_C_bottom_worst_THRU"
14.08223	1.20E-08	16.33863	0.211812	6.163321	1	2.817323	1	0	0	"R35 top normal--OSFP_S_C_top_normal_THRU"
14.15368	3.06E-08	15.75215	0.203984	6.405605	1	2.688891	1	0	0	"R36 top worst--OSFP_S_C_top_worst_THRU"
15.10004	6.76E-07	15.91909	0.174047	7.469802	1	3.841096	1	0	0	"R37 bottom normal--QSFP_S_C_bottom_normal_THRU"
15.58335	2.37E-05	9.805058	0.159433	9.668445	1	3.290195	1	0	0	"R38 bottom worst--QSFP_S_C_bottom_worst_THRU"
14.5299	9.24E-08	15.71644	0.183242	6.73728	1	3.9059	1	0	0	"R39 top normal--QSFP_S_C_top_normal_THRU"

data

14.49324	3.53E-06	14.71914	0.143459	8.328781	1	3.271589	1	0 ""R40 top worst--QSF2_S_C_top_worst_THRU""
15.31618	1.16E-06	11.8456	0.191141	7.724426	1	3.586666	1	0 ""R41 1_legacy top normal--QSF2_S_C_legacy_top_normal_THRU""
15.27382	4.84E-07	12.77493	0.197685	7.355679	1	3.89874	1	0 ""R42 2_additional top normal--QSF2_S_C_additional_top_normal_THRU""
14.84529	1.61E-06	13.1952	0.186588	7.891982	1	4.130343	1	0 ""R43 3_additional bottom normal--QSF2_S_C_additional_bottom_normal_THRU""
14.43567	7.30E-07	13.17631	0.18436	7.547226	1	3.578604	1	0 ""R44 4_legacy bottom normal--QSF2_S_C_legacy_bottom_normal_THRU""
15.75957	2.60E-05	9.08229	0.159934	9.761333	1	3.031577	1	0 ""R45 5_legacy top worst--QSF2_S_C_legacy_top_worst_THRU""
15.85839	4.24E-06	11.02472	0.173851	8.425944	1	3.374145	1	0 ""R46 6_additional top worst--QSF2_S_C_additional_top_worst_THRU""
15.20287	6.71E-06	10.93857	0.168473	8.710525	1	3.650547	1	0 ""R47 7_additional bottom worst--QSF2_S_C_additional_bottom_worst_THRU""
14.36098	1.17E-05	10.65508	0.175025	9.093495	1	3.317805	1	0 ""R48 8_legacy bottom worst--QSF2_S_C_legacy_bottom_worst_THRU""
15.54387	5.18E-04	6.067911	0.110484	14.21894	1	5.84004	1	0 ""R49 tracy_100GEL_02_0118--THRU_Host_Tx4_Mod_Tx4_OIF_Long_Barrel""
16.48338	2.40E-07	14.35814	0.171243	7.025436	1	4.70605	1	0 ""R50 tracy_100GEL_02_0118--THRU_Host_Tx5_Mod_Tx5_OIF_Long_Barrel""
16.08129	2.41E-04	7.62964	0.113874	12.6911	1	5.999134	1	0 ""R51 tracy_100GEL_02_0118--THRU_Host_Tx6_Mod_Tx6_OIF_Long_Barrel""
13.9325	1.93E-04	9.249872	0.131669	12.24775	1	4.340603	1	0 ""R52 tracy_100GEL_02_0118--THRU_Host_Tx7_Mod_Tx7_OIF_Long_Barrel""
15.32467	8.74E-07	15.97773	0.168322	7.606758	1	5.429452	1	0 ""R53 tracy_100GEL_02_0118--THRU_Host_Tx8_Mod_Tx8_OIF_Long_Barrel""
15.35773	1.41E-06	14.98364	0.171429	7.829036	1	4.305372	1	0 ""R54 tracy_100GEL_02_0118--THRU_Host_Tx3_Mod_Tx3_OIF_Long_Barrel""
14.4795	9.85E-05	8.854066	0.146691	11.16396	1	7.490902	1	0 ""R55 tracy_100GEL_06_0118--THRU_Host_Rx3_Mod_Rx3_OIF_microvia""
14.50604	4.37E-06	13.90063	0.157044	8.456414	1	6.159696	1	0 ""R56 tracy_100GEL_06_0118--THRU_Host_Rx4_Mod_Rx4_OIF_microvia""
14.56797	4.94E-05	10.58718	0.154539	10.35771	1	7.532609	1	1 ""R57 tracy_100GEL_06_0118--THRU_Host_Rx5_Mod_Rx5_OIF_microvia""
14.5928	2.26E-06	13.83574	0.163685	8.094933	1	6.388921	1	0 ""R58 tracy_100GEL_06_0118--THRU_Host_Rx6_Mod_Rx6_OIF_microvia""
14.35547	3.66E-05	10.98019	0.157134	10.06425	1	7.832799	1	0 ""R59 tracy_100GEL_06_0118--THRU_Host_Rx7_Mod_Rx7_OIF_microvia""
14.40502	1.52E-05	11.86009	0.151422	9.299785	1	5.756735	1	0 ""R60 tracy_100GEL_06_0118--THRU_Host_Rx8_Mod_Rx8_OIF_microvia""
12.74594	7.37E-07	17.10117	0.188454	7.540152	2	5.637424	1	1 ""R1 12dB--12dB_thru""
14.01873	6.08E-07	15.89619	0.19589	7.467768	2	4.616613	1	1 ""R2 14dB--14dB_thru""
15.82964	2.41E-06	11.5048	0.176939	8.13896	2	3.125771	1	1 ""R3 16dB--16dB_thru""
12.19198	2.02E-06	17.636	0.190475	8.034514	2	5.719332	1	1 ""R4 12dB--12dB_thru""
13.98771	6.00E-06	13.80112	0.175012	8.66869	2	4.23276	1	1 ""R5 14dB--14dB_thru""
15.95873	2.55E-06	11.08928	0.170755	8.152772	2	2.644902	1	1 ""R6 16dB--16dB_thru""
10.0301	1.25E-05	13.7443	0.117592	9.170436	2	5.948553	1	1 ""R7 10dB--100GEL_C2M_10dB_Thru""
12.12298	9.85E-06	12.48105	0.099217	8.996215	2	4.750253	1	1 ""R8 12dB--100GEL_C2M_12dB_Thru""
15.89888	1.44E-05	7.754112	0.112804	9.273873	2	1.926835	1	1 ""R11 16dB--100GEL_C2M_16dB_Thru""
10.0301	1.25E-05	13.7443	0.117592	9.170436	2	5.948553	1	1 ""R12 10dB--100GEL_C2M_10dB_Thru""
12.12298	9.85E-06	12.48105	0.099217	8.996215	2	4.750253	1	1 ""R13 12dB--100GEL_C2M_12dB_Thru""
8.945554	1.84E-09	27.99929	0.240588	5.898876	2	9.627989	1	1 ""R15 mellitz_3ck_01_0518_C2M--C2M_Z100_IL9_BC-BOR_N_N_N_THRU""
9.95607	1.26E-05	16.15298	0.173593	9.186429	2	7.742118	1	0 ""R16 mellitz_3ck_01_0518_C2M--C2M_Z100_IL10_WC-BOR_H_L_H_THRU""
11.16053	2.04E-09	21.9871	0.22464	5.931835	2	8.281739	1	1 ""R17 mellitz_3ck_01_0518_C2M--C2M_Z100_IL11p2_BC-BOR_N_N_N_THRU""
12.18229	6.00E-06	15.3747	0.18224	8.627905	2	6.443039	1	0 ""R18 mellitz_3ck_01_0518_C2M--C2M_Z100_IL12_WC-BOR_H_L_H_THRU""
13.12136	1.33E-09	19.28112	0.22399	5.897852	2	6.559332	1	1 ""R19 mellitz_3ck_01_0518_C2M--C2M_Z100_IL13_BC-BOR_N_N_N_THRU""
13.86565	4.60E-06	12.52708	0.181346	8.446665	2	5.66545	1	0 ""R20 mellitz_3ck_01_0518_C2M--C2M_Z100_IL14_WC-BOR_H_L_H_THRU""
14.6602	8.57E-06	9.773902	0.171488	8.868885	2	-0.006271	0	0 ""R21 bottom normal--CFP2_S_C_bottom_normal_THRU""
14.72862	2.22E-05	9.266878	0.161501	9.6314	2	-0.530874	0	0 ""R22 bottom worst--CFP2_S_C_bottom_worst_THRU""

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14.8863	4.34E-08	15.16669	0.183981	6.481569	2	1.507813	1	0 ""R23 top normal--CFP2_S_C_top_normal_THRU""
15.09546	3.71E-08	13.19882	0.188796	6.42597	2	1.333021	1	1 ""R24 top worst--CFP2_S_C_top_worst_THRU""
15.56608	1.33E-08	13.53876	0.199354	6.179916	2	0.812038	1	1 ""R25 bottom normal--CFP8_S_C_bottom_normal_THRU""
15.80796	3.22E-08	12.58124	0.191483	6.405057	2	0.260243	1	0 ""R26 bottom worst--CFP8_S_C_bottom_worst_THRU""
15.07284	3.35E-08	13.19434	0.189224	6.40235	2	1.419075	1	0 ""R27 top normal--CFP8_S_C_top_normal_THRU""
15.48293	6.16E-07	13.15743	0.171568	7.398143	2	0.612158	1	1 ""R28 top worst--CFP8_S_C_top_worst_THRU""
16.50059	2.30E-06	11.17473	0.152789	8.050933	2	-1.559272	0	0 ""R29 bottom normal--DSFP_S_C_bottom_normal_THRU""
16.0969	3.38E-07	12.49612	0.169392	7.129676	2	-1.277842	0	0 ""R30 bottom worst--DSFP_S_C_bottom_worst_THRU""
14.71436	2.74E-07	11.14352	0.172329	7.054244	2	0.210408	1	0 ""R31 top normal--DSFP_S_C_top_normal_THRU""
14.8289	2.16E-07	11.36878	0.16383	6.97856	2	0.32798	1	0 ""R32 top worst--DSFP_S_C_top_worst_THRU""
14.1961	2.59E-09	14.00075	0.205655	5.870178	2	1.69078	1	1 ""R33 bottom normal--OSFP_S_C_bottom_normal_THRU""
14.41707	6.71E-08	13.03585	0.18755	6.626668	2	1.515089	1	0 ""R34 bottom worst--OSFP_S_C_bottom_worst_THRU""
14.08223	3.05E-08	14.15249	0.19627	6.389344	2	1.255546	1	0 ""R35 top normal--OSFP_S_C_top_normal_THRU""
14.15368	4.00E-07	12.95382	0.177379	7.228733	2	1.135297	1	0 ""R36 top worst--OSFP_S_C_top_worst_THRU""
15.10004	2.49E-07	12.57381	0.168407	7.075137	2	2.316052	1	0 ""R37 bottom normal--QSFP_S_C_bottom_normal_THRU""
15.58335	1.10E-05	9.369826	0.15792	9.053143	2	1.769334	1	0 ""R38 bottom worst--QSFP_S_C_bottom_worst_THRU""
14.5299	6.40E-08	14.80229	0.170201	6.593288	2	2.380884	1	0 ""R39 top normal--QSFP_S_C_top_normal_THRU""
14.49324	1.59E-06	11.17637	0.144736	7.869888	2	1.765743	1	0 ""R40 top worst--QSFP_S_C_top_worst_THRU""
15.31618	5.28E-06	9.340174	0.175419	8.551761	2	2.057645	1	0 ""R41 1_legacy top normal--QSPDD_S_C_legacy_top_normal_THRU""
15.27382	4.06E-06	10.13062	0.153358	8.381848	2	2.386058	1	0 ""R42 2_additional top normal--QSPDD_S_C_additional_top_normal_THRU""
14.84529	1.30E-06	11.76198	0.181031	7.772803	2	2.615764	1	0 ""R43 3_additional bottom normal--QSPDD_S_C_additional_bottom_normal_THRU""
14.43567	6.01E-07	11.57311	0.178293	7.413786	2	2.033992	1	0 ""R44 4_legacy bottom normal--QSPDD_S_C_legacy_bottom_normal_THRU""
15.75957	4.78E-05	7.341211	0.147287	10.37573	2	1.5121	1	0 ""R45 5_legacy top worst--QSPDD_S_C_legacy_top_worst_THRU""
15.85839	4.36E-05	8.488788	0.127574	10.2817	2	1.878173	1	0 ""R46 6_additional top worst--QSPDD_S_C_additional_top_worst_THRU""
15.20287	5.75E-06	9.684872	0.162887	8.619206	2	2.148543	1	0 ""R47 7_additional bottom worst--QSPDD_S_C_additional_bottom_worst_THRU""
14.36098	4.97E-06	9.398568	0.176649	8.517891	2	1.785486	1	0 ""R48 8_legacy bottom worst--QSPDD_S_C_legacy_bottom_worst_THRU""
15.54387	1.54E-04	6.431319	0.128848	11.89343	2	4.33244	1	0 ""R49 tracy_100GEL_02_0118--THRU_Host_Tx4_Mod_Tx4_OIF_Long_Barrel""
16.48338	2.24E-05	8.499795	0.143758	9.664332	2	3.209501	1	0 ""R50 tracy_100GEL_02_0118--THRU_Host_Tx5_Mod_Tx5_OIF_Long_Barrel""
16.08129	3.52E-05	8.808982	0.139092	10.10923	2	4.510857	1	0 ""R51 tracy_100GEL_02_0118--THRU_Host_Tx6_Mod_Tx6_OIF_Long_Barrel""
13.9325	1.56E-05	10.02912	0.151803	9.344381	2	2.792637	1	0 ""R52 tracy_100GEL_02_0118--THRU_Host_Tx7_Mod_Tx7_OIF_Long_Barrel""
15.32467	3.83E-06	12.10429	0.151375	8.34712	2	3.906618	1	0 ""R53 tracy_100GEL_02_0118--THRU_Host_Tx8_Mod_Tx8_OIF_Long_Barrel""
15.35773	3.03E-06	11.4301	0.142917	8.203019	2	2.751899	1	0 ""R54 tracy_100GEL_02_0118--THRU_Host_Tx3_Mod_Tx3_OIF_Long_Barrel""
14.4795	7.99E-06	10.01688	0.166335	8.846501	2	5.961593	1	0 ""R55 tracy_100GEL_06_0118--THRU_Host_Rx3_Mod_Rx3_OIF_microvia""
14.50604	2.34E-07	12.23274	0.187412	7.046515	2	4.613827	1	0 ""R56 tracy_100GEL_06_0118--THRU_Host_Rx4_Mod_Rx4_OIF_microvia""
14.56797	6.79E-06	11.2041	0.16859	8.733727	2	6.025273	1	1 ""R57 tracy_100GEL_06_0118--THRU_Host_Rx5_Mod_Rx5_OIF_microvia""
14.5928	2.29E-07	14.30357	0.185747	7.070743	2	4.839657	1	0 ""R58 tracy_100GEL_06_0118--THRU_Host_Rx6_Mod_Rx6_OIF_microvia""
14.35547	2.14E-06	11.25091	0.171883	8.033712	2	6.329437	1	0 ""R59 tracy_100GEL_06_0118--THRU_Host_Rx7_Mod_Rx7_OIF_microvia""
14.40502	7.18E-07	12.7465	0.182702	7.511425	2	4.194099	1	0 ""R60 tracy_100GEL_06_0118--THRU_Host_Rx8_Mod_Rx8_OIF_microvia""